The above object and other objects, features and advantages of the present invention are readily apparent from the following detailed description of the preferred embodiment when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic diagram illustrating an embodiment of the present invention;

FIGURE 2 is a circuit diagram illustrating an embodiment of the present invention;

FIGURE 3 illustrates an article of manufacture made in accordance with the present invention; and

FIGURE 4 is a flow chart illustrating a method of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Figure 1, a transmitter circuit of the present invention is generally indicated at 10. Transmitter circuit 10 includes an oscillator circuit 12 and an amplifier circuit 14. Control logic 16 is operative to turn the oscillator on and off and is operative to generate a data signal in response to assertion of pushbutton switch 18. More specifically, control logic 16 may be implemented as a microprocessor or microcontroller, and produces a signal at 20 to turn on oscillator circuit 12 and also produces a data signal at 22. Oscillator circuit 12 includes oscillation source 24 and stabilizing SAW resonator 25. Oscillator circuit 12 produces a carrier signal at 26. The carrier signal at 26 is received by amplifier circuit 14, through coupling capacitor 28, at input 32. Amplifier circuit 14, in addition to receiving the carrier signal, also receives a data signal through input resistor 30. In turn, the carrier signal is modulated with the data signal, and amplifier 34 of amplifier circuit 14 produces an output signal at 36 as the carrier

signal modulated with the data signal. The output signal is transmitted by antenna 38 which is coupled to amplifier circuit 14.

It is appreciated that embodiments of the present invention utilize an oscillator circuit to produce an unmodulated carrier signal and then modulate the carrier signal with the data signal at the amplifier circuit. By allowing the oscillator circuit to run continuously, instead of switching the oscillator circuit off and on, the maximum data rate is increased. For example, in a prior art SAW stabilized transmitter having a maximum data rate of 2.5 kHz, providing the improvement contemplated by the present invention (that is, modulating the carrier signal with the data signal at the amplifier circuit) extends the maximum data rate to better than 1 MHz. Of course, the improvement to the maximum data rate may vary depending on the application as appreciated by one of ordinary skill in the art. In addition, embodiments of the present invention have improved battery life of the transmitter because the data is transmitted much faster, and therefore the average on time of the unit is much lower. Further, the increased maximum data rate allows for higher radiated peak power because duty factor may be kept lower. And further, embodiments of the present invention decrease latency time between transmitter operation and receiver response, therefore allowing for more feature content in the transmitted data.

In a suitable implementation of the transmitter circuit shown in Figure 1, when pushbutton 18 is depressed, output 20 goes from a low state to a high state and remains high throughout the period of data transmission. After the output 20 has been at a high state for a period of 25 microseconds (in this example), then data output 22 outputs data to amplifier circuit 14, turning the amplifier 34 on and off at the data rate. It is appreciated that any SAW stabilized oscillator configuration may be used and any type and/or number of amplifiers may be used.

The SAW stabilized oscillator requires a certain amount of time to turn on (25 microseconds in this example), therefore limiting the data rate which can be transmitted directly through the oscillator. In accordance with the present invention, the addition of the amplifier allows the oscillator to run continuously and

the amplifier can shift the output power of the oscillator at a maximum data rate limited by the switching speed of the amplifier.

Figure 2 illustrates a suitable circuit level implementation for the transmitter circuit of Figure 1, with the circuit being generally indicated at 60. Transmitter circuit 60 includes battery power source (BAT) but may optionally include any other suitable power source. Switch SW1 is connected to an input pin of integrated circuit chip U1. Capacitors C4 and C5 stabilize the supply voltage to the rest of transmitter circuit 60. An oscillator circuit 62 includes resistors R1, R2, and R3, and capacitors C1 and C2, as well as transistor Q1, inductor L1, and SAW resonator X1. In the presence of a signal from integrated circuit chip U1 sufficient to turn on transistor Q1, oscillator circuit 62 provides an oscillating output. Amplifier circuit 64 includes resistors R4, R5, and R6, as well as capacitor C6, transistor Q2, and inductor L2. The data signal is presented by integrated circuit chip U1 in response to the assertion of switch SW1. Prior to providing the data signal, integrated circuit chip U1 turns on transistor Q1. The carrier signal from oscillator circuit 62 is coupled with capacitor C3 such that the carrier signal is modulated with the data signal at the input of amplifier circuit 64. Preferably, on/off keying is performed, but other modulation techniques may also be used. The antenna coupled to amplifier circuit 64 transmits the output signal of amplifier circuit 64. Further, the carrier signal preferably has a frequency above 300 MHz.

Figure 3 illustrates an article of manufacture made in accordance with the present invention at 70. Article 70 is a transmitter suitable for many applications and includes a housing 72 and at least one circuit board 74. The circuit board 74 includes a transmitter circuit of the present invention such as the exemplary transmitter circuit of Figure 2. Pushbutton 76 causes the transmitter to modulate the carrier signal with the data signal and transmit the output signal. Embodiments of the present invention are suitable for many applications such as, for example, garage door openers, keyless entry, and tire pressure monitoring. That is, the article of manufacture may take any of a number of forms. In addition, other aspects of the transmitter configuration may vary depending on the application. For example, the